

Abstract of the Disclosure

5        This invention relates to a novel fluidized bed membrane reactor for  
autothermal operations. More particularly, this invention pertains to a unique  
fluidized bed membrane reactor which includes internal catalyst solids circulation  
for conveying heat between a reforming zone and an oxidation zone. A method of  
producing hydrogen gas from a hydrocarbon gas and steam comprising forming a  
10       fluidized bed of a suitable particulate catalyst in a reactor, wherein the catalyst is  
disposed in the reactor in two reaction modes, the first being an endothermic  
dehydrogenation reaction mode and the second being an exothermic oxidation or  
partial oxidation reaction mode, introducing a mixture of steam and hydrocarbon  
gas into the bottom of the fluidized bed to fluidize the particulate catalyst and form  
the fluidized bed, reacting the steam and hydrocarbon gas within the first endother-  
15       mic dehydrogenation reaction mode to produce hydrogen gas, separating said  
hydrogen gas from other gases in the first endothermic dehydrogenation reaction  
mode as molecular or atomic hydrogen through a perm-selective membrane that  
permits the transfer of hydrogen therethrough while preventing or minimizing the  
transmission therethrough of the other gases in the endothermic dehydrogenation  
20       reaction mode, introducing oxidant in the second exothermic oxidation or partial  
oxidation reaction mode, and mixing same with other gases in the second exother-  
mic oxidation and partial oxidation mode, and directing resultant oxidized gases to  
the first endothermic dehydrogenation reaction mode.